

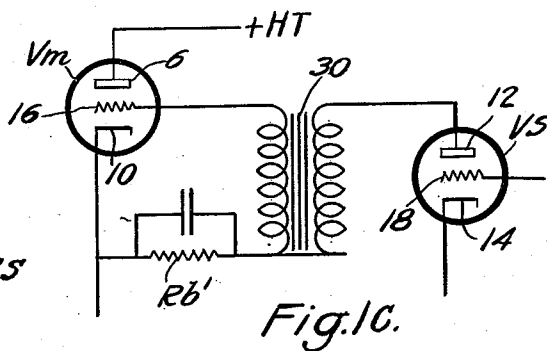
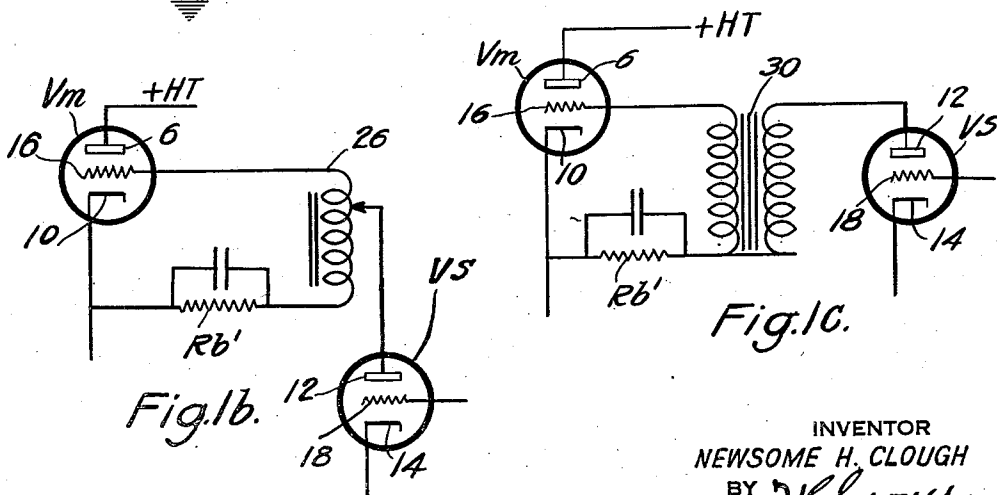
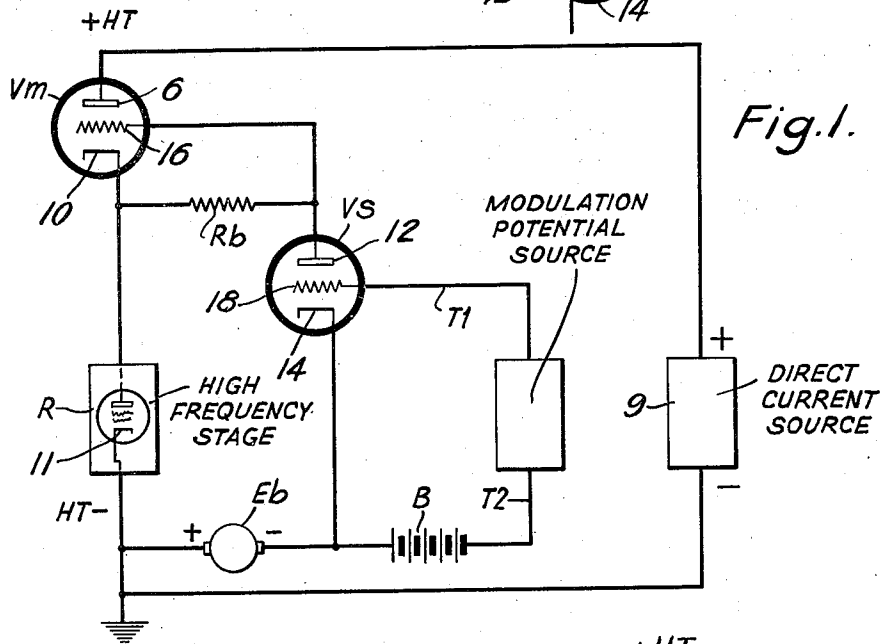
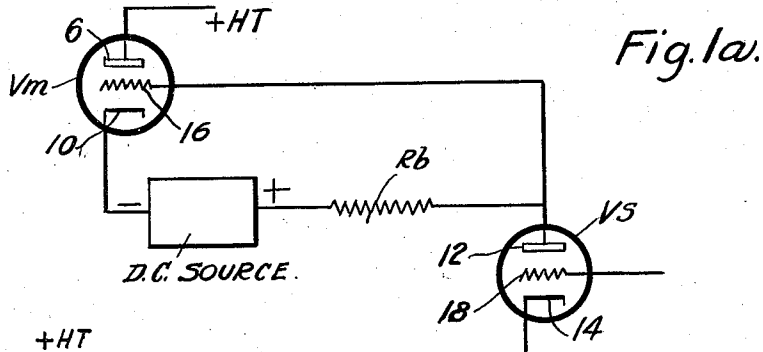
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MODULATOR ARRANGEMENT

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MODULATOR ARRANGEMENT

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This invention relates to amplifier arrangements and more particularly, though not exclusively, to amplifier arrangements for modulated carrier wave radio transmitters. The invention has for its main object to provide coupling arrangements between so-called sub-modulator and modulator valves.

According to this invention an amplifier arrangement comprises a main modulator stage connected in series with a stage at which modulation is to be effected across a source of potential, a circuit including a direct, current permeable impedance in series with a sub-modulator stage being connected across said second mentioned stage, and the junction of said impedance with said sub-modulator stage being connected to the grid of the main modulator stage, modulating potentials being applied between the grid of the sub-modulator stage and the cathode thereof.

In describing my invention reference will be made to the attached drawing wherein Figure 1 illustrates a modulation system comprising a main modulator stage, a modulated stage coupled thereto, and a sub-modulator stage connected with the main modulator stage and the modulated stage, and Figures 1a, 1b and 1c each show a modification of the arrangement in Figure 1. In the modification of Figure 1a a direct current source is added in the coupling between the main modulator and the sub-modulator. In Figure 1b a reactor is added in the coupling between the main modulator and the sub-modulator, while in Figure 1c a transformer is used in this coupling.

In one way of carrying out this invention illustrated in the accompanying drawing, there is employed a main modulator valve V_m having its anode 6 connected to the positive terminal $HT+$ of a direct current source 9 and its cathode 10 connected to the high potential terminal of a high frequency carrier stage—usually a “driven” high frequency amplifier—these elements being represented, in general, by the reference R. The cathode 11 of the high frequency valve is connected to earth and to the negative terminal $HT-$ of the direct current source. The cathode 10 of the modulator valve V_m is also connected, through a resistance R_b , to the anode 12 of a sub-modulator valve V_s , whose cathode 14 is connected to earth through a source E_b of negative bias potential, for example a direct current generator. The anode 12 of the sub-modulator valve V_s is also directly connected to the grid 16 of the modulator valve V_m . Input modulating

potentials are applied to the grid 18 of the sub-modulator valve V_s and through a source B of potential to the cathode of said sub-modulator, said source of potential having its positive terminal towards said cathode.

The operation of the arrangement is as follows:

In the absence of modulation input the voltage drop across the modulator valve and that across the resistance R_b are approximately equal and the current in each is half the maximum which flows for 100% modulation. For these conditions the sub-modulator valve V_s is so biased that the voltage drop due to its anode current in the resistance R_b is substantially equal to the bias required by the modulator valve V_m at the voltage and current at which it is operating. If now the grid, connected to the terminal T1, of the sub-modulator valve V_s is made sufficiently negative with respect to the other modulation input terminal T2 to prevent current flow in the sub-modulator valve even at the full value of high tension voltage, there will be no voltage drop across the resistance and the bias on the modulator valve V_m will be removed. If, on the other hand, the grid of the sub-modulator valve V_s is made positive relatively to the previous potential thereof or relatively to T2 by an amount equal to the steady voltage between said cathode and the said other modulation input terminal T2, (i. e. equal to the bias voltage provided by the source B) the sub-modulator bias will, in effect, be removed. In consequence the increased current through the resistance R_b will apply more bias to the modulator valve, and this will reduce the current passed by the modulator valve V_m , in turn reducing the voltage applied to the sub-modulator valve and preventing any great increase in current through the said resistance R_b . By suitable selection of the values of the said resistance R_b and of the auxiliary source E_b between the cathode of the sub-modulator valve and earth, it is possible to arrange for the voltage across the said resistance R_b , i. e. the modulator valve bias, in the condition mentioned, to approach cut-off. The two conditions, one where the grid of the sub-modulator valve V_s is negative and the other where the said grid is positive, both with respect to the said other modulation input terminal, correspond respectively to the “peak” and “trough” of deep modulation. Where less deep modulation is required, the auxiliary source E_b between the cathode of the sub-modulator valve and earth, might be omitted.

An advantage of the invention is that the cou-

pling between the sub-modulator and modulator valves is substantially purely resistive, and the circuit, therefore, is suitable not only for cases where sinusoidal inputs and outputs are in question, but also in cases where non-sinusoidal wave forms arise, e. g. for telegraph systems or for television systems.

In order to increase the upward swing of modulation it may be desirable, in some cases, to include a source of potential between the resistance R_b and the cathode of the modulator valve V_m , the negative end of said source being towards said cathode. This arrangement has been shown in Figure 1a. In practice this source of potential might take the form of a rectifier and filter circuit receiving input from an extra winding on a transformer normally employed for heating the filament or cathode of the modulator valve.

Alternatively in cases where direct current amplification is not involved, a check 26 may be substituted for the submodulator anode resistance R_b , bias for the modulator valve being provided by a capacity shunted resistance R_b' on the positive side of the choke as shown in Figure 1b. Where 100% modulation is required the choke may be extended beyond the sub-modulator anode, i. e. the said anode may be connected to a tap on the choke as shown in Figure 1b, or, instead of this tapped choke arrangement—which is, in effect, an auto-transformer arrangement, a double wound transformer 30 may be used as shown in Figure 1c, to reduce magnetic leakage.

Although the main application of the invention is to radio and like transmitters, and it has been particularly described as so applied, the invention is applicable to amplifier arrangements generally; for example, the high frequency stage hereinbefore referred to might be replaced by the resistance of a loudspeaker or an audio frequency load of any sort in cases in which it was required to amplify audio frequency.

What is claimed is:

1. In an amplifier system, two electron discharge devices each having an anode, a cathode and a control electrode, a source of direct current potential, a load circuit connected in series with the internal anode-cathode impedance of one of said devices, means coupling said series arrangement of load circuit and internal device impedance across said source of direct current potential, the anode of said one device being connected to the positive terminal of said direct current source, said load circuit being between the cathode of said one device and the negative terminal of said direct current source, an impedance connected to the anode of said other device and in series with the internal anode-cathode impedance of the other device, connections connecting said last series arrangement of said last named impedance and the internal impedance of said other device in shunt to said load circuit, a substantially direct connection between the anode of said other device and the grid of said one device, and means for impressing voltages to

be amplified on the grid and cathode of said other device.

2. In a modulation system, two electron discharge devices each having an anode, a cathode and a control electrode, a high frequency stage wherein high frequency energy to be modulated is set up and a source of direct current connected in series with the internal anode-cathode impedance of one of said devices, the positive terminal of said source of direct current being connected to the anode of said one device, said high frequency stage being connected between the cathode of said one of said devices and the negative terminal of said source of direct current, an impedance connected to the anode of the other device and in series with the internal anode-cathode impedance of said other device, connections connecting said last series arrangement of said impedance and said internal anode-cathode impedance of said other device in shunt to said high frequency stage, a substantially direct connection between the anode of said other device and the grid of said one device, and means for impressing modulating voltages on the grid and cathode of said other device.

3. A system as recited in claim 1, wherein a source of direct current potential is included in said connections connecting said last series arrangement of impedance and internal tube impedance in shunt to said load circuit.

4. In a modulation system, two electron discharge devices each having an anode, a cathode and a control electrode, a radio frequency stage and a source of direct current connected in series with the internal anode-cathode impedance of one of said devices, the positive terminal of said source of direct current being connected to the anode of said one device, said radio frequency stage being connected between the cathode of said one device and the negative terminal of said source of direct current, an impedance connecting the anode of the other device to the cathode of said one device, a source of direct current potential connecting the cathode of the other device to said radio frequency stage at its point of connection to the negative terminal of said direct current source, a connection between the anode of said other device and the grid of said one device, and means for impressing modulating potentials on the grid and cathode of said other device.

5. A system as recited in claim 4 wherein said impedance connecting the anode of said other device to the cathode of said one device is shunted by a condenser and wherein said connection between the anode of said other device and the grid of said one device includes an inductance.

6. A system as recited in claim 4 wherein said impedance connecting the anode of the other device to the cathode of said one device is shunted by a condenser and wherein said connection between the anode of said other device and the grid of said one device includes a transformer.

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